



Establishment of international air navigation Space Weather requirements

Space Weather Workshop
April 13-17, 2015, Boulder, Colorado

Raul Romero
Technical Officer, ICAO Headquarters, Montreal

Contents

- **Background**
- **Impact on aircraft operation**
- **Recent progress**
- **MET Divisional Meeting 2014**
- **Future steps**

SW as an additional hazard to aircraft operations



Background

- 
- Year 2000: New air trans-polar routes opened up between North America and East Asia
 - Later: Polar routes across the South Pole
 - Today: More than 10,000 operations in trans- or cross-polar routes per year (N and S Poles)
 - Polar trajectories are more cost effective for airlines
 - Shorter, more direct, long-haul routes
 - saving fuel and minimizing environmental impact
 - ...and more convenient for passengers
 - Less time in the air

BACKGROUND

ICAO MET Divisional
Meeting
(2002)

Recommendation 1/20c)

ANC

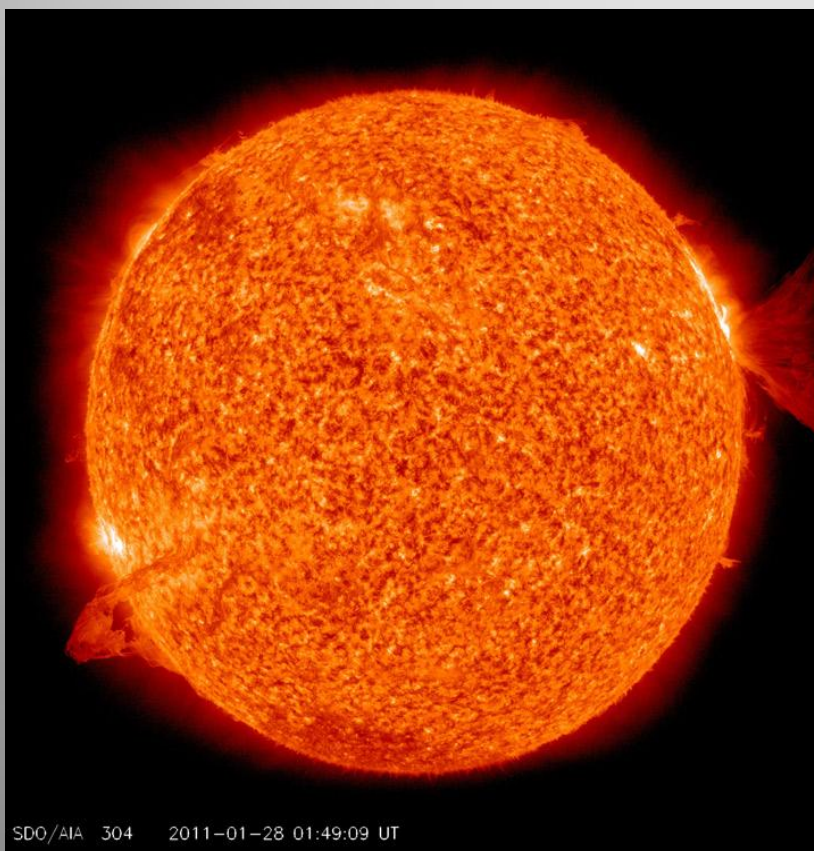
IAVW Operations Group
(2004 – present)

Conclusions 1/33, 3/31,
4/29, 5/18, 5/19 and 6/31

Deliverable IAVWOPSG-09

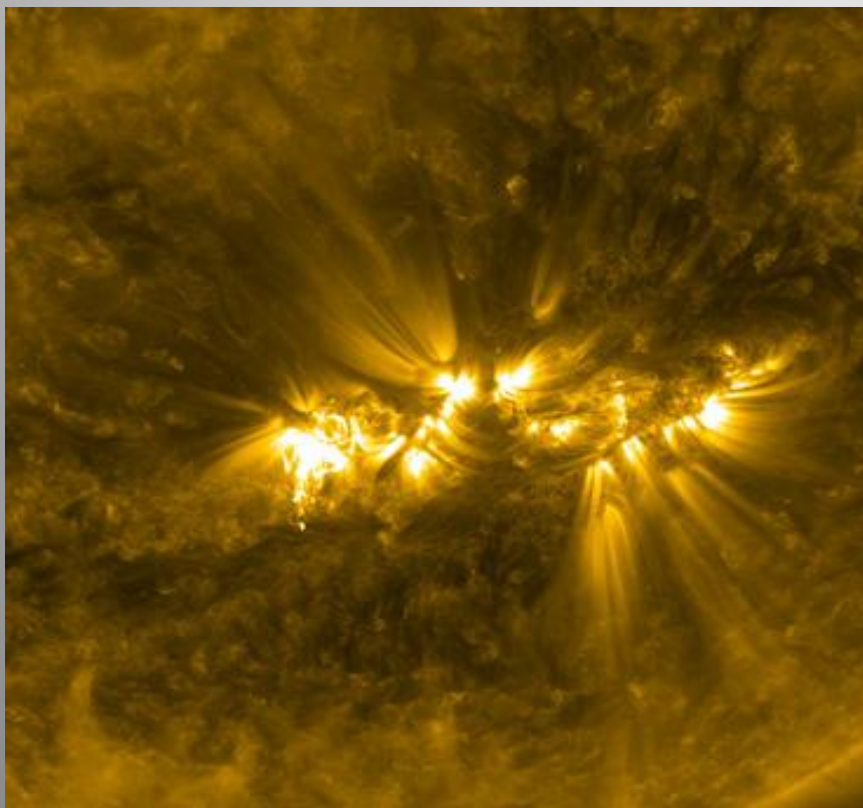
- Recognition that aircraft operating on high latitude polar routes could be exposed to **hazardous levels** of solar radiation that **could affect crew and passenger health, communications, navigation and avionics**
- Recommendation that an assessment be conducted of the need for the provision of information for international air navigation on solar radiation storms and other bio-hazards

Impact on aircraft operation



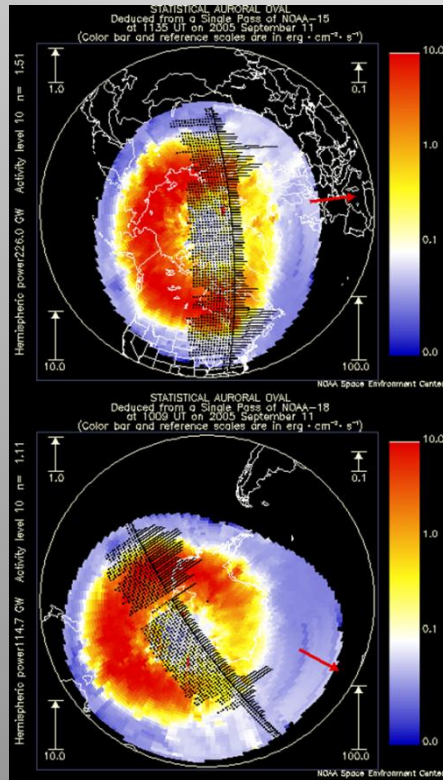
- Space weather can cause GPS position errors, or even total loss of “lock”
- Space weather can cause loss of both voice and data link communications

Impact on aircraft operation



- Radiation exposure is a concern to aircraft occupants during high latitude flights
- Sophisticated onboard avionics are vulnerable to solar radiation storms

Use of the SW information



The timely notification of space weather activity allows users to undertake mitigation action increasing flight safety and efficiency, especially during polar operations

Recent progress

- Development of initial guidance material on space weather with emphasis on the description of the impact of space weather on international air navigation
- 4 States plus WMO
- Available at:
<http://www.icao.int/safety/meteorology/iavwopsg/>
- Development of **draft requirements** for Space Weather
 - Drafting of operational requirements and associated guidance material
 - Development of milestones for the development and roll-out of a Space Weather service for international air navigation
- 7 States, IATA, IFALPA, IFATCA, in coordination with ICAO and WMO

Recent progress

- Development of **operational requirements** for space weather products
 - High-level user requirements from IATA
 - Draft Concept of Operations for international space weather information in support of aviation
 - State feedback
 - Product requirement specification (Report to IAVWOPSG/7, March 2013)
- ICAO 12th Air Navigation Conference (Nov 2012)
- ICAO MET Divisional Meeting conjoint with WMO CAeM-XV (Jul 2014)



- Assessed the work carried out by the IAVWOPSG to develop draft initial provisions
- Recommended to address:
 - ✓ requirements for information concerning space weather
 - ✓ establishment of optimal number of global centres
 - ✓ augmented by an optimal number of regional centres



- **Global centres (for solar radiation storms and solar flares, as well as for geomagnetic storms and ionospheric disturbances at the predictive stage)**
- **regional centres (for geomagnetic storms and ionospheric disturbances at the observation stage)**



Need for further work on:

- a) roles, requirements and capabilities of the global and regional centres (together with the optimal number of centres)
- b) development of a process for the designation of global and regional centres, their governance (including cost recovery and competency standards) and duration of mandate

Future steps

ICAO expected to establish an expert group on SW under the umbrella of the MET Panel (First Meeting April 20-24, 2015), in close coordination with WMO

Expert group on SW to undertake work in accordance with the mandate of MET Divisional Meeting 2014

Future steps

ICAO expert group on space weather (with the assistance of WMO (ICTSW)) to:

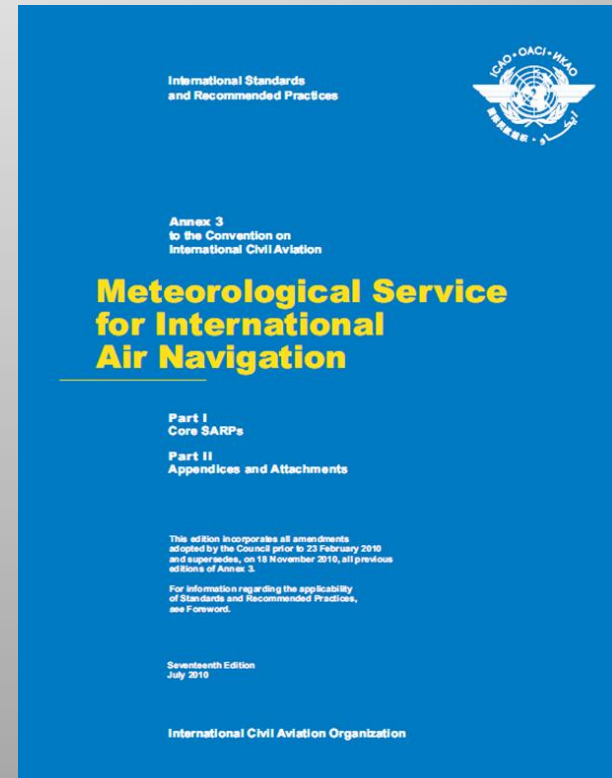
- a) **Complete development of SW requirements** in line with the Global Air Navigation Plan and integrating the information in the future system-wide information management (SWIM);
- b) Advise ICAO about **capabilities** of the global and regional centres to be designated, its **governance and mandate**.

2013–2028
Global Air Navigation Plan



Future steps

- Nomination by ICAO of **global centres** and by PIRGs of **regional centres**;
- Inclusion of **SW requirements in Amendment 78 (Nov 2018) to ICAO Annex 3 – Meteorological Service for International Air Navigation**;
- Development of appropriate **guidance material**;
- **Implementation** of SW provisions; and,
- **Monitoring of SW information provision** to ensure that it continues to meet evolving operational requirements



Space Weather information provision in support of ICAO Strategic Objectives

A. Safety:

Enhance global civil aviation safety.

B. Air Navigation Capacity and Efficiency:

Increase capacity and improve efficiency of the global civil aviation system.





ICAO

UNITING AVIATION



ICAO

North American
Central American
and Caribbean
(NACC) Office
Mexico City

South American
(SAM) Office
Lima

ICAO
Headquarters
Montréal

Western and
Central African
(WACAF) Office
Dakar

European and
North Atlantic
(EUR/NAT) Office
Paris

Middle East
(MID) Office
Cairo

Eastern and
Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Sub-office
Beijing

Asia and Pacific
(APAC) Office
Bangkok



THANK YOU